

Marine Fisheries Policy Brief - 2

Seasonal Fishing Ban



CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

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Foreword



Fish is a renewable natural resource but not in-exhaustible. The transformation of the fishing sector from subsistence fishing to the status of an industry has necessitated implementation of various conservation measures for sustainable harvesting and to maintain the equity issues. Conservation of this resource has been emphasized since time immemorial by different means including traditional community based fisheries management. Unmanaged or unregulated fishery may cause several problems ranging from resource extinction to socio-economic conflicts. To avoid such conflicts, the Government of India is promulgating fishing ban or closed seasons every year for fishing vessels in the Indian Exclusive Economic Zone during the last two decades. However the ban is received by the stakeholders with mixed reaction as very few attempts have been made to assess the impact of the ban on the marine fisheries.

The Marine Fisheries Policy Brief, **Seasonal fishing ban**, the second in the series, has made a systematic attempt to assess the impact of fishing ban covering (i) livelihood issues during the ban period, (ii) post-ban impacts on fish landings in terms of quantity, quality and value, (iii) impact on fishery related activities during the ban and post-ban periods and (iv) elicit the views/comments of the coastal states/Union Territories, fishermen organizations/associations and other stakeholders. The exhaustive analysis of the marine fish landings, catch, effort and price data and the responses of the stakeholders have led to realistic conclusions, which have formed the basis for policy recommendations. I take this opportunity to congratulate the team led by Dr. E. Vivekanandan, Head, Demersal Fisheries Division for his keen interest in the preparation of this policy brief. I hope this document will be of immense use to the administrators, policy planners, researchers, academicians and fishers for improving marine fisheries management in the country.

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Dr. G. Syda Rao
Director

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Introduction

Fishery resources need to be monitored and managed to maintain harvest at sustainable levels as they provide food and livelihood security to millions of population. Management of fisheries is not confined to management of stocks alone but it should consider all the stakeholders associated with the sector directly or indirectly such as fishers, traders, those involved in post-harvest operations and those who provide support services to the sector. Besides, fish stocks live in a highly variable and a complex ecosystem and are affected by human interventions and vagaries of nature, which emphasises the need for including the risk and uncertainty factors in the management strategies. In recent years, we are witnessing several conflicts among different stakeholders of the fisheries sector, which arise mostly due to sharing the limited resources and income disparities. The management measures adopted in temperate countries are not directly adoptable to the multi-species and multi-gear tropical fisheries of India. Hence we have to formulate fishery management policy considering the domestic situations and promote sustainable fishing practices that will not decrease the stock level, but will ensure livelihood security, resource sustainability, economic efficiency and ecosystem integrity (Srinath and Pillai, 2008).

Management measures in India

The management of fisheries in India is governed by rules and regulations formulated under the Indian Fisheries Act 1897 and later under the Marine Fisheries Regulation Act 1978. The government of India in 1977 enacted the Exclusive Economic Zone Act extending the rights to explore, exploit and utilise the living and non-living resources available within 200 nautical mile zone from the shore. As development of marine fisheries in the territorial waters extending up to 12 nautical miles from the shore is a subject of maritime states, the states have formulated rules and regulations for management of the resources.

The regulatory measures formulated under the above Acts and Regulations by and large cover prohibition of exploitation of resources by destructive gears, explosives and poison. The other regulatory measures adopted are as follows:

1. Restriction of number of fishing boats
2. Restriction of number of fishing gears which exploit juveniles in the backwaters, estuaries and shallow inshore waters
3. Mesh size regulation
4. Minimum legal length for capture
5. Seasonal ban on fishing
6. Restriction of fishing areas
7. Protection of endangered species
8. Marine Protected Areas

Although seasonal fishing ban (SFB) is just one of the many tools available for fisheries management, it is the only instrument which is being diligently followed in the country. Maritime states along the west and east coasts of India are implementing closed season of 45 to 75 days

for mechanised fishing vessels as a corollary to their Marine Fishing Regulation Acts. Earlier there was no uniformity of ban period, but after the intervention of the Ministry of Agriculture, Government of India, the ban has been made uniform all along the west coast (June 15 - July 31) and east coast (April 15 – May 31) states and Union Territories.

Protecting the spawners during peak spawning season, reducing the fishing effort and giving respite to the benthic fauna from intense trawling are major reasons for seasonal closure of fishing. However, SFB has been generating controversies since inception. There are questions about the efficiency of SFB in long-term sustainability and enhancement of fish stocks. A section of fishermen complain loss of employment during the ban period. After inception of the ban, several committees were formed to review the efficiency, period, duration and impact of ban. Barring one or two, all the committees have advocated continuation of the ban as a measure of conserving the fishery resources and to aim at sustainable harvest.

Since the inception of ban, the marine fisheries sector has undergone immense technological, economic and social changes. In this background, the question “what has been the impact of SFB?” is relevant. An attempt has been made to address this question by (i) analysing data on fishing effort and landings collected by CMFRI in the last two decades, (ii) conducting stakeholders’ meetings to know their opinion, and (iii) consulting reports of earlier committees. This exercise has helped to arrive at conclusions on the impact of seasonal fishing ban and provide recommendations for sustainability of resources.

Status of SFB in different maritime states

The ban duration, season, and type of craft exempted from ban by different maritime states is not uniform (Table 1). Kerala was the first

Table 1. Seasonal fishing ban along maritime states*

State/Union Territory	Year of introduction	Notified period	Days	Type of fishing banned	Type of fishing permitted
Gujarat	1998-99	10 June-15 August	67	All craft	Nil
Maharashtra	1990	10 June-15 August	67	All craft	Nil
Daman & Diu		1 June-15 Aug	75	Trawlers, gillnetters and dol netters	Motorised and traditional craft
Goa	1989	10 June-15 August	67	All craft	Nil
Karnataka i) Dakshina Kannada	1989	15 June-10 Aug	57	All except motorised OBM/IBM vessels upto 25 hp engine	Motorised upto 25 hp engine
ii) Uttara Kannada		15 June-29 July	45		
Kerala	1988	15 June-31 July	47**	Mechanised vessels / motorised craft >10 hp engine	All traditional and motorised craft of OBM/IBM up to 10 hp engine
Tamil Nadu and Puducherry	2001	15 April-31 May	47	Mechanised fishing/ trawlers	All non motorised and motorised craft with less than 25 hp engine
Andhra Pradesh	2000	15 April-31 May	47	Trawlers and motorised craft with >25hp engine	Traditional and motorised craft <25hp engine
Orissa	2000	15 April-15 June	60	Trawlers and motorised craft with > 25 hp engine	Traditional and motorised craft < 25 hp engine
West Bengal	1995	15 April-31 May	47	Trawlers, gillnetters, behundi nets, bir net	NA

* Subject to year to year change; **61 in 1988 & 67 in 2006; NA - Not Available

state to introduce the ban in 1988 followed by Goa, Karnataka and Maharashtra. By the year 2000, the measure was in vogue in all the maritime states. Gujarat, Goa and Maharashtra follow total ban during the period. All other states allow motorised and traditional craft with limitations on the engine horsepower.

Expert committee recommendations on seasonal fishing ban

The demand for seasonal ban came as a consequence of the rampant gear conflicts between the mechanised and traditional sectors in Kerala in the late seventies. A number of committees were constituted to make an informed position on the continuation of the ban. Table 2 summarises the position taken by these committees. It can be seen that, over the years, the committees have taken a less ambiguous position on the need for the seasonal fishing ban.

Table 2. Views of expert committees on Seasonal Fishing Ban

Committee	Views of the Committees on SFB
Babu Paul (1982)	No consensus on desirability of SFB
Kalawar (1985)	Shrimp trawling during monsoon season (June , July and August) be permitted , but restricted to daytime and beyond 20 m depth.
Nair (1989)	Ban on trawling by all types of vessels during June-August. Impact should be studied after three years.
Silas (1994)	Closure to be restricted to 20 m depth; No ban on trawling beyond territorial waters.
Nair (2000)	Extension of ban for 90 days
Mohan Joseph Modayil (2005)	Total closure except traditional/OBM/IBM with less than 10 hp; Ban of 47 days on both coasts but different seasons
Singh (2007)	Mandatory ban on bottom trawling using mechanised craft during monsoon period from 15 June to 31 July (47 days).

Closed seasons for shrimp trawling in different countries

Many fishing nations of the world enforce seasonal ban as a conservation measure. The imposition of such a ban dates back to centuries. A snapshot of seasonal ban on shrimp trawling enforced in different countries is given in Table 3.

Table 3. Closed season for shrimp trawling*

Country	Duration	Season
Kenya	4 months	November – March
Madagascar	3 months	November - February
Mozambique	3 months	NA
South Africa	4 months	November - February
Bahrain	4 months	1 March to 31 July
Saudi Arabia	5 months	August - January
New Zealand	9.5 months	1 November - 14 August
Brazil	3 months	October to January
Guyana	2 months	October, November
The Netherlands	2.5 months	February 15 - April 30
Indonesia	29 years (1980-2009)	Throughout year
NS Sicily	1990 onwards (exclusion zone/area zoning)	Throughout year
Queensland/ Australia	1985 onwards (area closure)	Throughout year
UK	3 months	January – March
Texas, USA	2 months since 1981 and in 2005 moratorium on fleet size	May 15 – July 15

* collected from various sources; NA - Not Available

The closure period ranges from 45 days (Texas/ USA) to 9 months (New Zealand). But in most cases, the duration is for two months or more, which seems to be necessary for rejuvenation of shrimp stocks. Indonesia has banned trawling altogether for 29 years.

IMPACT OF SEASONAL BAN ON FISHING EFFORT AND LANDINGS

The best way to assess the impact of SFB would be to analyze historical fishing survey data from commercial fishing grounds with sufficient stretch before the ban period. In India, there is no such time series data which could be relied upon. So the alternative is to depend upon primary information collected on commercial fish landings across the coastline of the country. This approach has inherent bias, which would skew the catches and their rates of catch higher as commercial fishing is more selective and targeted towards productive grounds. But as these commercial catch statistics are an accepted index of the status of the resources under focus, an insight into their trends would be scientifically tenable albeit with some caveats. Hilborn (2002) suggests that annual rates or percentages of difference in catches would be more robust in indicating the status of stocks. Various other intrinsic and extrinsic factors square off resulting in expression of changes in annual rates. Hence it is acceptable to use macro data of fish catches and efforts collated over years to study the pattern followed by the stock *vis-a-vis* fishery.

India, with a coastline of 8129 km and an extensive EEZ of 2.02 million square kilometers, has an estimated annual marine fishery potential of 3.9 million tonnes (Anon, 2000). Indian marine fisheries is typically multi-species and multi-gear. In recent years, fishing is extending to oceanic and deeper waters, augmented by innovative fishing gear modifications. Diverse craft–gear combinations target the same group of fishes, which leads to inter and intra-sectoral competition. In this section, the trend in landings, both annual and seasonal, and their corresponding catch rates have been analysed for each coastal region of the country.

Region-wise analysis of marine fish landings

The quarterly gear-wise and species-wise catch and effort data estimated for each coastal state of mainland of India during 1985-2008 by the Central Marine Fisheries Research Institute (CMFRI) and deposited at the National Marine Living Resource Data Centre (NMLRDC) were analyzed. The analysis was carried out separately for each state and the results were pooled for four regions namely the northeast (West Bengal and Orissa), southeast (Andhra Pradesh, Tamil Nadu and Puducherry), southwest (Kerala, Karnataka and Goa) and northwest (Maharashtra, Gujarat and Daman and Diu) coasts. The following are the reasons for this regional approach: (i) There is ecological similarity within each region. (ii) There is a striking similarity in the catch composition of marine fish landings within each region. (iii) The fishing fleet, especially the multi-day mechanised boats often cross the borders of neighbouring states, conduct fishing within the region, but land the catch at the port of origin. (iv) The period of fishing ban is almost the same within the region.

The landings and effort in the years prior to and after introduction of SFB were compared between the pre and post ban years in each region. Similarly, the catch, effort and catch rate in the quarter (season) prior to and after the ban each year were compared. In the east coast, the comparison was made between Quarter I (January-March) and III (July-September), whereas in the west coast, the comparison was between Quarter II (April-June) and IV (October-December). The catch per unit effort (CPUE) for all the gears (except trawls) and catch per hour (CPH) for the mechanised trawlers for each coastal region, during pre-ban years and ban years as well as pre and post ban seasons were estimated. Unit effort refers to one fishing trip from the port of embarkation to the port of disembarkation. For estimating CPUE, the effort expended by different craft was standardised using the method described by Anon (2000).

Trends in catch and catch rate along southeast coast

Southeast coast contributed 23% to the Indian marine fish landings during 1985-2008 with annual average landings of 5.4 lakh tonnes. The annual landings increased from 3.4 lakh tonnes in 1985 to 6.6 lakh tonnes in 2008. On an average, the highest contribution was by the mechanised sector (50%), followed by non-mechanised (traditional) (30%) and motorised sectors (20%) (Fig. 1). Compared to other three regions, the catch contribution by the non-mechanised sector was higher along the southeast coast. The seasonal ban on mechanised units from 2000/2001 did not affect their contribution in the subsequent years. The estimated annual landings of the mechanised trawlers during the pre-ban years along the coast ranged from 1.23 lakh tonnes in 1985 to 3.12 lakh tonnes in 1995 with an annual average of 2.35 lakh tonnes and that of the ban years ranged from 2.05 lakh tonnes in 2005 to 3.41 lakh tonnes in 2008, with an annual average of 2.55 lakh tonnes.

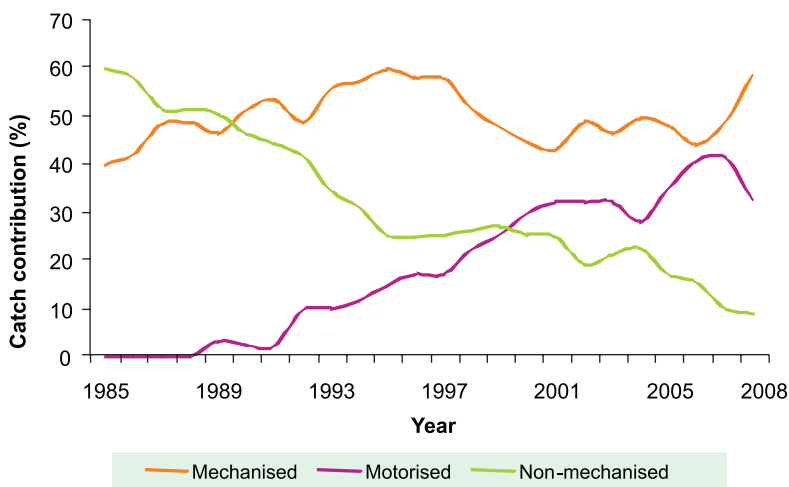


Fig. 1. Contribution by sectors to the landings along southeast coast during 1985-2008

The annual average effort by all the craft along this coast reduced by 5,93,058 units in the ban years from that of the pre-ban years. The CPUE was increasing since 1985, but from 2001 onwards the increase was more obvious compared to the previous years (Fig. 2). During 1985-2008, the CPUE was low whenever the effort was high (Fig. 3). This indicates that the CPUE could be increased by reducing the effort.

Even though the annual effort of mechanised trawlers along the coast is increasing over the period, the pace of increase during ban years is less compared to the pre-ban years. The seasonal effort of mechanised trawlers increased by 10% during the third quarter (after the ban season) compared to that of the first quarter (pre-ban season). The annual average catch per hour of the mechanised trawlers during the pre-ban and ban years were 34 kg h^{-1} and 30 kg h^{-1} , respectively. Thus the seasonal ban has not helped increase the CPH of trawlers.

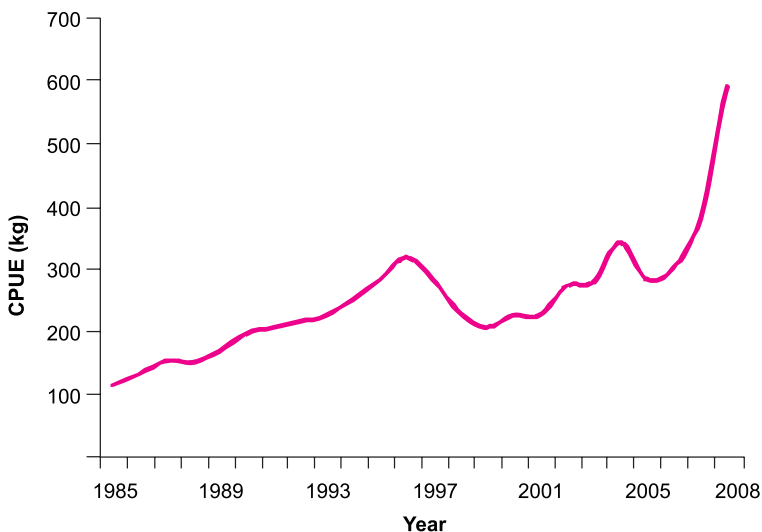


Fig. 2. Trend in catch per standard unit effort along the southeast coast of India during 1985-2008

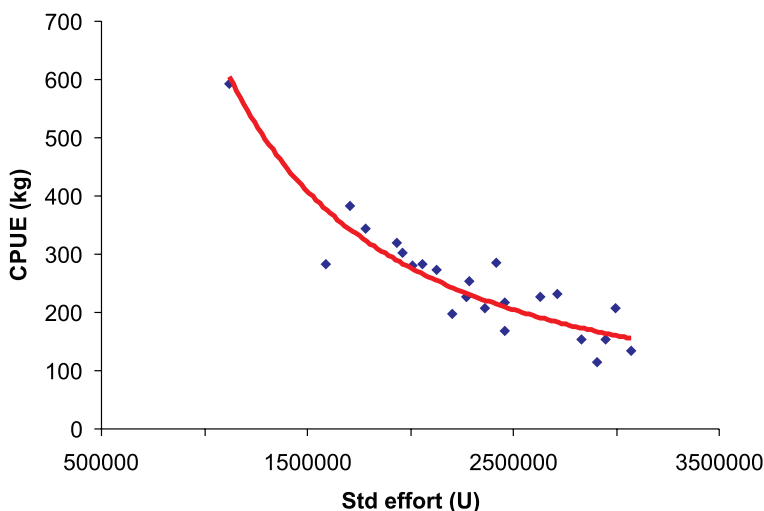


Fig. 3. Catch per unit effort against standard effort along the southeast coast of India during 1985-2008

Trends in catch and catch rate along northeast coast

The annual average landings along the northeast coast during 1985-2008 were 1.72 lakh tonnes with contribution of 7% to marine fish production of India. The annual landings increased from 0.70 lakh tonnes in 1985 to 4.83 lakh tonnes in 2008, registering a contribution of 15% to the national marine fish production in 2008. Mechanised (81%) and motorised (16%) sectors dominate the fishery (Fig. 4). There is remarkable increase in the landings by mechanised trawlers in recent years. The annual landings of the trawlers during the ban years ranged from 5.5 lakh tonnes in 2001 to 20 lakh tonnes in 2008 with an average of 9.6 lakh tonnes.

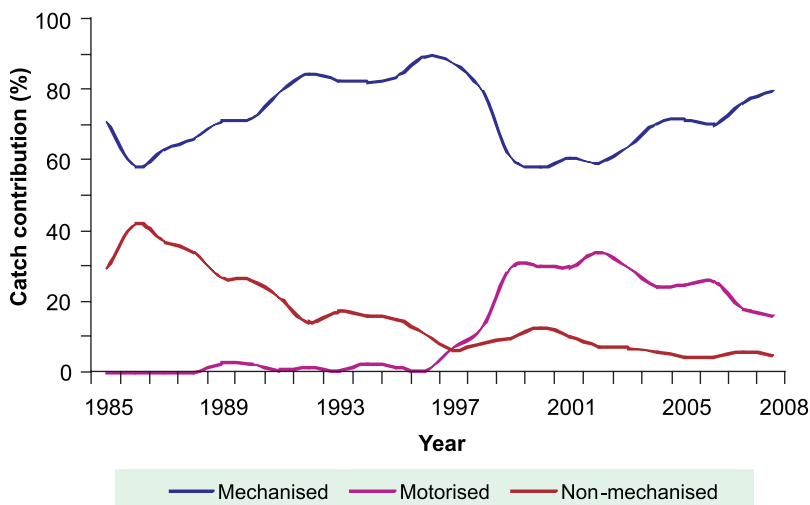


Fig. 4. Contribution by sectors to the landings along the northeast coast during 1985-2008

The annual average effort by all the craft reduced by 63,947 units in the ban years from that of pre-ban years. The CPUE marginally increased since 1985, and there was a steep increase from 2001 onwards (Fig. 5). Along this coast also, the CPUE registered low values whenever the effort was high (Fig. 6).

The effort by mechanised trawlers in the post-ban season decreased by 16% from that of the pre-ban quarter. The annual average catch per hour of the trawlers during the pre-ban years was marginally higher (47 kg h^{-1}) than that in the ban years (43 kg h^{-1}). This indicates that the seasonal ban has not helped increase the CPH of trawlers substantially.

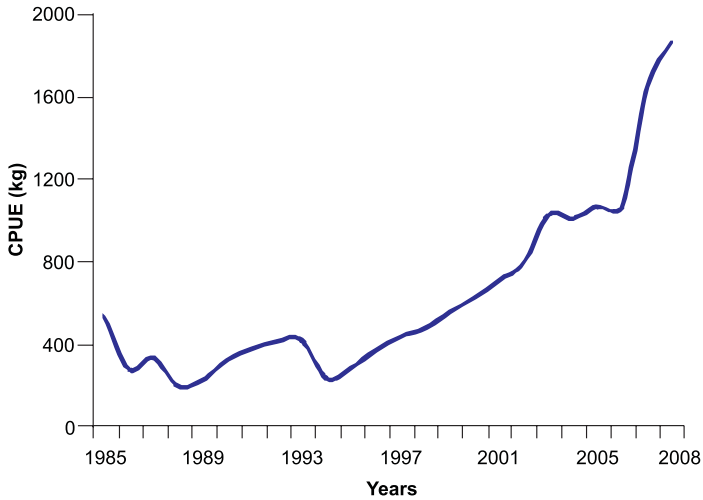


Fig. 5. Trend in catch per standard unit effort along the northeast coast during 1985-2008

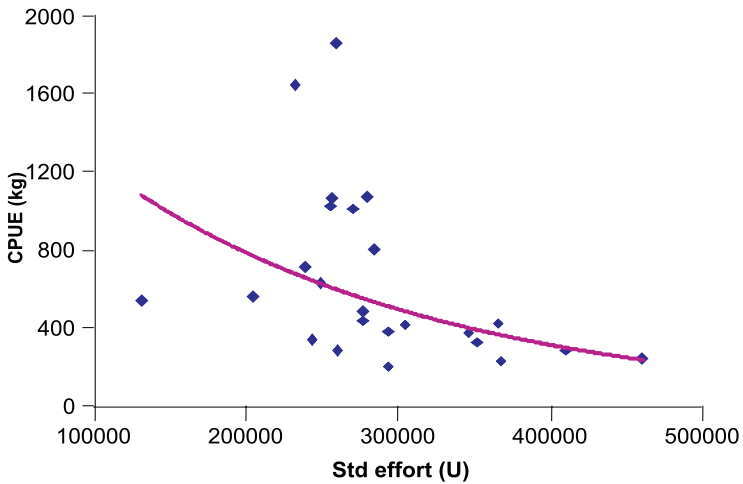


Fig. 6. Catch per unit effort against standard effort along the northeast coast during 1985-2008

Trends in catch and catch rate along southwest coast

The annual landings along the southwest coast progressively increased from 4.93 lakh tonnes in 1985 to 11.10 lakh tonnes in 2008 with an average of 8.20 lakh tonnes, contributing 35% to the national marine fish production. The mechanised sector was the major contributor (58%), followed by the motorised (34%) and non-mechanised sectors (8%) (Fig. 7). Among the mechanised units, trawlers and purse seiners shared almost all the landings of the sector with a contribution of 70% and 30%, respectively. The annual landings of trawlers during the pre-ban years ranged from 1.5 lakh tonnes in 1985 to 3.11 lakh tonnes in 1988 with an annual average of 2.52 lakh tonnes and that of the ban years ranged from 2.5 lakh tonnes in 1991 to 4.43 lakh tonnes in 1994 with an annual average of 3.40 lakh tonnes.

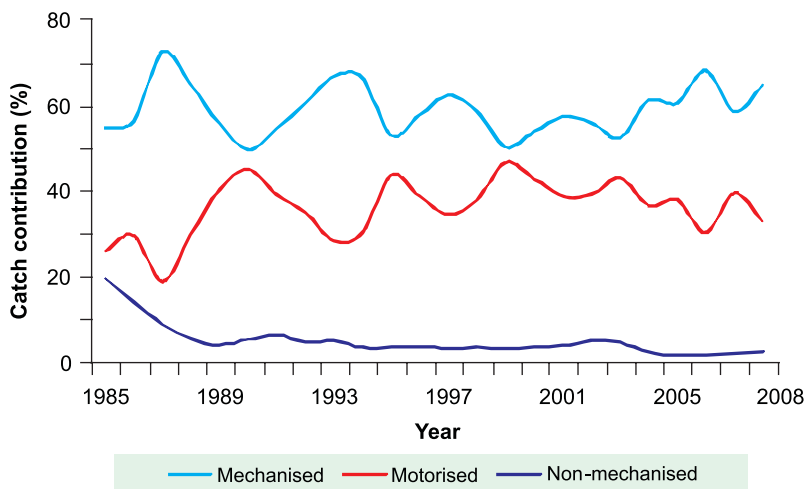


Fig. 7. Contribution by sectors to the landings along southwest coast during 1985-2008

The annual effort by all the craft increased by 1,28,927 units during the ban years from that of the pre-ban years. The increase in the total effort is mainly due to induction of more number of motorised units, which are exempted from ban during the monsoon season. The CPUE was decreasing from 1989 to 1998, but from 1999 onwards there was an increase in catch per unit effort (Fig. 8). During 1985-2008, there was a reduction in CPUE with increasing effort (Fig. 9).

The effort by mechanised trawlers in the post-ban season marginally decreased by 2% from that of pre-ban season. The annual average catch per hour of the mechanised trawlers during the pre-ban years was 66 kg h⁻¹, which reduced to 49 kg h⁻¹ in the ban years.

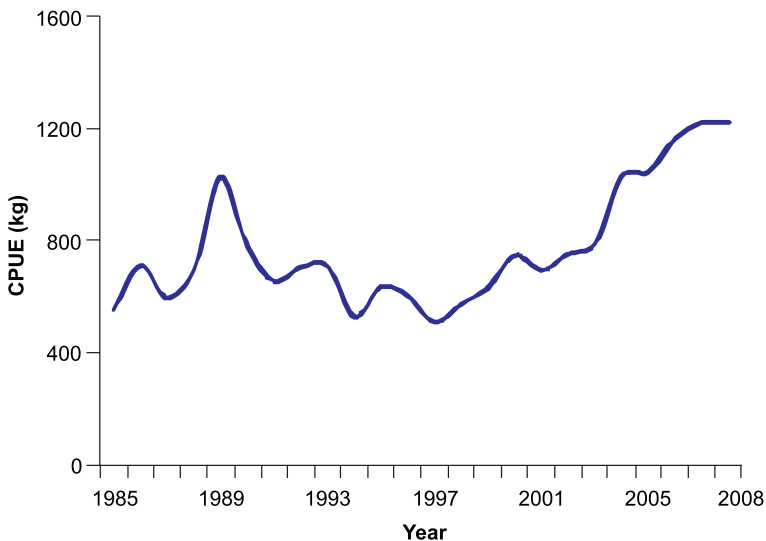


Fig. 8. Trend in catch per standard unit effort along the southwest coast of India during 1985-2008

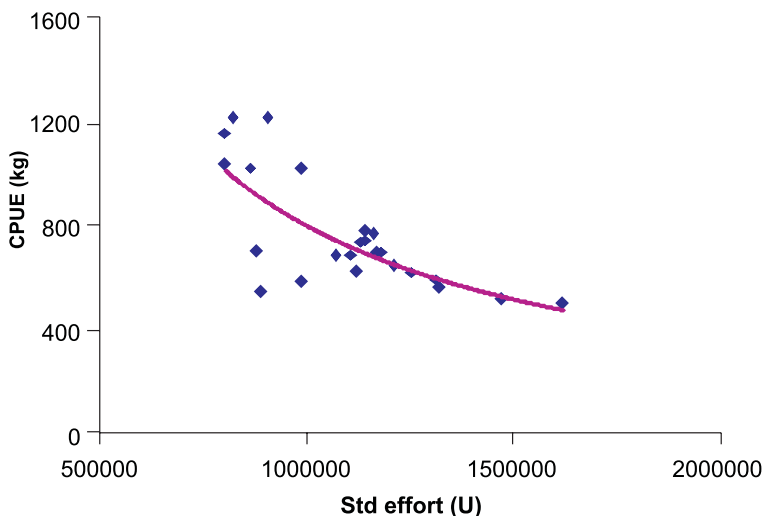


Fig. 9. Catch per unit effort against standard effort along the southwest coast during 1985-2008

Trends in catch and catch rates along northwest coast

The annual average landings along the northwest coast during 1985-2008 was estimated as 8.07 lakh tonnes contributing 34% to the total Indian marine fish landings. The annual landings increased from 6.23 lakh tonnes in 1985 and registered the highest of 11.48 lakh tonnes in 1998. In 2008, it was 8.95 lakh tonnes, which formed 28% of the national marine fish production. The landings by mechanised units account for the bulk of the production. The share of motorised and non-mechanised sectors to the landings along the northwest coast is very low compared to the other three coasts. The mechanised sector contributed 94% to the catch, followed by non-mechanised sector (5%) and motorised sector (1%) (Fig.10). The annual landings of the mechanised trawlers during the pre-ban years ranged from 2.64 lakh

tonnes in 1986 to 2.75 lakh tonnes in 1987 with an average of 2.67 lakh tonnes and in the ban years from 3.10 lakh tonnes in 1989 to 7.10 lakh tonnes in 1998 with an average of 5.24 lakh tonnes.

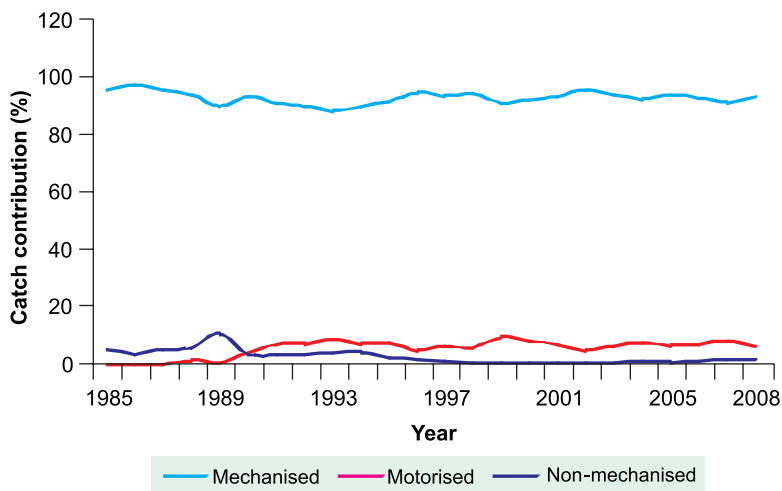


Fig. 10. Contribution by sectors to the landings of northwest coast during 1985-2008

The annual average effort by all the craft reduced by 1,01,049 units during the ban years from that of the pre-ban years. The CPUE is increasing since 1985 (Fig. 11). During 1985-2008, the CPUE was low whenever the effort was high (Fig. 12). Hence the catch per unit effort is higher in the years of seasonal ban.

The landings by mechanised trawlers show an increasing trend from 1985 onwards, as the effort was also increasing over the years. There was considerable increase (91%) in the effort of mechanised trawlers in the third quarter, i.e., in the season after the ban. The annual average catch per hour (CPH) of trawlers during the pre-ban and ban years were 58 kg h⁻¹ and 54 kg h⁻¹, respectively. Thus the seasonal ban has not helped increase the CPH of trawlers.

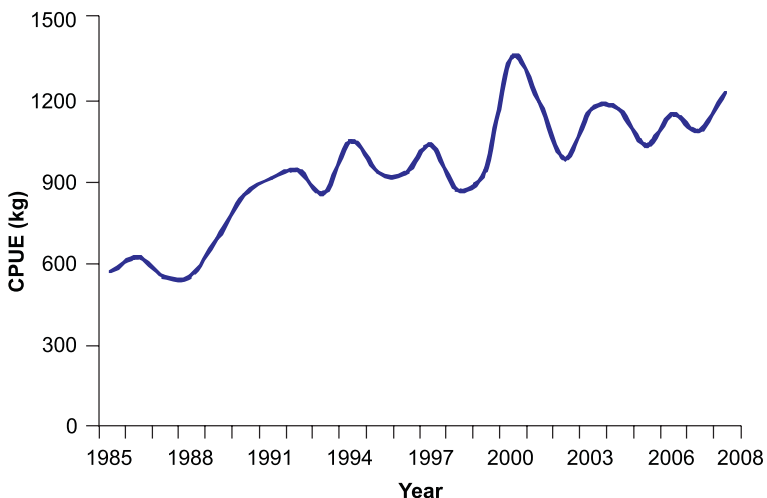


Fig. 11. Trend in catch per standard unit effort along the northwest coast of India during 1985-2008

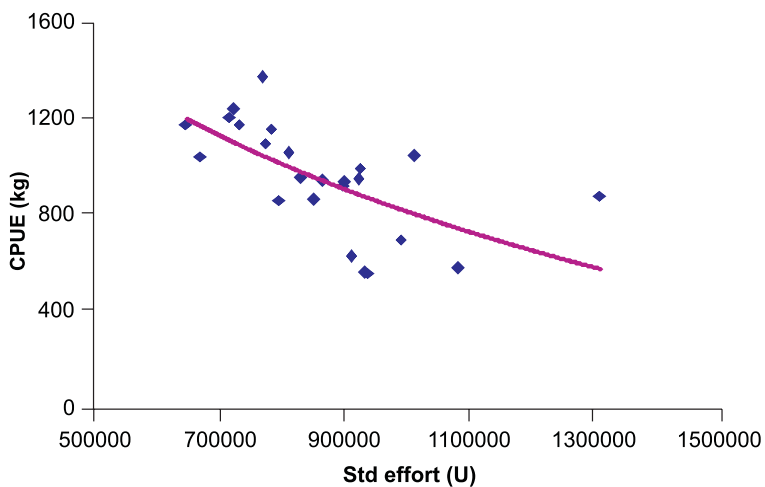


Fig. 12. Catch per unit effort against the standard effort along the northwest coast during 1985-2008

MSY ESTIMATES AND NO-BAN SCENARIOS

The fishing effort, which in the long term gives the highest yield, is termed as f_{MSY} and the corresponding yield is termed as Maximum Sustainable Yield (MSY). MSY estimates are important in arriving at optimum fishing strategy which gives the highest steady yield year after year. In this section, the following analyses have been made: (i) MSY and f_{MSY} for each coastal region; (ii) projection on fishing effort and catches had there been no seasonal ban on fishing; (iii) biological growth of harvested species during the ban period; and (iv) economic valuation of biological growth increment during the ban period.

Method of analysis

MSY and f_{MSY} estimates

The MSY in tonnes as well as the f_{MSY} in number of fishing units, were calculated by fitting the functional relationship between C/f and f as $C/f = a - b \times f$ (Schaefer, 1954), where C = catch and f = fishing effort.

$$MSY = a^2/4b$$

$$f_{MSY} = -a/2b$$

For the estimation, the trawl catches of each coastal region were categorised into five groups, namely, demersal finfishes, small pelagics, penaeid prawns, cephalopods and others. Time series catch per unit effort of the resources exploited by all the gears and the catch per unit hour of the resources exploited by mechanised trawlers during pre-ban years was subjected to analysis using Schaefer's prediction model, to arrive at the expected CPUE and CPH during the ban years. The results so obtained were compared with the actual CPUE and CPH during the ban years. The difference between the two CPUE and CPH values were expressed as percentage variation from that of the predicted value.

Growth increment during closed season

It is expected that the biomass of resources would have increased during the ban period. In order to estimate the weight increment of important resources exploited by the major mechanised gears during ban period, the following growth formula of von Bertalanffy (1936) was used:

$$W_{t_i} = W_{\infty} (1 - \exp(-kt_i))^3$$

where the W_{t_i} is the weight of fish at age t_i , k is the annual growth coefficient and W_{∞} is weight at L_{∞} . The k value as well as the length - weight relationship of the major species representing the resources exploited by the mechanised gears were collected from a number of published sources and used to find out the weight increment.

The increment factors were used to estimate total increment in the biomass of resources from the catch data of the previous month of ban.

Economic valuation

The economic benefit of SFB was assessed by estimating the value of incremental growth that was attained due to fishing ban. The incremental weight (in tonnes) of each species was multiplied by the price/tonne (geometric mean of the last three years at the landing centre price level and retail price level) of the respective species and the final value was estimated. The valuation of incremental growth was arrived at as follows:

$$I_v = \sum_{i=1}^n q_i p_i$$

where,

I_v = incremental value during the ban period

q_i = incremental growth (biomass) of species

p_i = price per kg of the species

i = species

Regional estimates and projections

Southeast coast

The MSY and f_{MSY} estimates show that the average effort in the region during the ban years is 7% lower than that of the f_{MSY} , whereas the average effort during the pre-ban years was 19% higher than the estimated f_{MSY} for MSY of 6.29 lakh tonnes (Table 4).

The Schaefer prediction analysis indicates that, had there been no reduction in effort due to ban, the CPH of mechanised trawlers would have reduced to 24 kg/h. However, the CPH during the ban years remained at 34 kg h⁻¹. The ban has helped sustaining the CPH, which would have otherwise decreased by 27%. The CPH of demersal finfishes was higher by about 120% during the ban years compared to the predicted CPH had there been no ban, and that of the penaeid prawns by 12%. This indicates that the reduction of effort increases the catch rate of trawlers. The biomass increment during 45-day fishing ban for resources exploited by mechanised craft was 4,466 tonnes, which is 8% higher than the catch for the period, had there been no ban (Table 5).

Table 4. The estimated MSY and f_{MSY} of four coastal regions; and the deviation of actual fishing effort from f_{MSY}

Parameters	SE	NE	SW	NW
MSY (t)	6,29,064	2,36,793	8,53,597	8,30,925
f_{MSY} (units)	19,49,724	2,48,731	10,65,416	9,51,491
Effort (units) during ban years	18,21,821	2,60,179	11,34,665	8,43,825
Effort (units) during pre-ban years	24,14,879	3,24,126	10,05,738	9,44,874
Deviation (%) in effort from f_{MSY} during ban years	-7	4	6	-13
Deviation (%) in effort from f_{MSY} during pre-ban years	19	23	-6	-1

Table 5. The estimated catch increment and value of the resources exploited by the mechanised units for 45-day fishing ban

Parameters	SE	NE	SW	NW	All India
Catch in 45-days, if there is no fishing ban (t)	57,943	30,659	63,599	39,730	191,931
Estimated catch for 45 days during fishing ban (t)	62,409	33,377	69,258	43,205	208,250
Increment in catch during 45-day ban period (t)	4,466	2,719	5,716	3,475	16,376
Increment in catch for 45-days fishing ban (%)	8	9	9	9	9
Value of the incremental catch in 45-days at landing centre level (Rs. in lakhs)	2,202	1,563	4,901	2,304	10,970
Value of the incremental catch in 45-days at retail market level (Rs. in lakhs)	3,682	2,702	8,345	3,506	18,235

Northeast coast

The average effort in the ban years is 4% higher than that of the f_{MSY} , whereas the average effort during the pre-ban years was 23% higher than the estimated f_{MSY} for MSY of 2.4 lakh tonnes.

If there was no reduction in effort due to ban, the CPH of mechanised trawlers would have reduced to 30 kg h⁻¹ in the ban years. However, the CPH remained at 43 kg h⁻¹ during the ban years. The ban has helped achieve better CPH which would have otherwise decreased by 43%. The CPH of demersal finfishes in mechanised trawlers increased by 39% in the ban years compared to that of the pre-ban period. The biomass increment of resources exploited by mechanised craft during the 45-day fishing ban was 2,719 tonnes, which is 9% more than the catch for the period, had there been no ban (Table 5).

Southwest coast

The average effort by the fishing units in the ban years is 6% higher than that of the f_{MSY} , whereas the average effort recorded during the pre-ban years was 6% lower than the estimated f_{MSY} corresponding to the MSY of 8.53 lakh tonnes.

Had there been no reduction in effort due to ban, there would have been steep reduction in the CPH of trawlers. The average catch per hour of each resource showed a similar trend. The CPH of penaeid prawns increased by 4% during the ban years compared to the predicted CPH in the ban years. In the case of demersal finfishes, the increase in catch per hour was about 120% compared to that of the predicted value. The biomass increment for the 45-day ban period was 5,716 tonnes, which is 9% more than the catch for the period, had there been no ban.

Northwest coast

The average effort in the ban years is 13% lower than that of the f_{MSY} , whereas the average effort during the pre-ban years was only 1% lower than the estimated f_{MSY} , corresponding to MSY of 8.31 lakh tonnes. There was SFB every year since the early 1980s imposed by fishermen, which has helped maintaining the average effort below the f_{MSY} .

Had there been no reduction in effort due to ban, the CPH of trawlers would have reduced to 29 kg h⁻¹. The average CPH during the ban period was 55 kg h⁻¹. It may be concluded that the ban has helped sustaining the CPH, which would have otherwise decreased by 89%. The estimated catch increment during the 45-day SFB in terms of biological growth of species exploited by mechanised gears was 3,471 tonnes, which is 9% more than the expected catch for the period, had there been no fishing ban (Table 5).

Economic impact

At the landing centre level, the value realised from the incremental growth during the ban season was highest along the southwest coast at Rs. 4,901 lakhs, followed northwest coast (Rs. 2,304 lakhs), southeast coast (Rs. 2,202 lakhs) and northeast coast (Rs. 1,563 lakhs). At the retail price level, the estimated value was the highest along the southwest coast at Rs. 8,345 lakhs, followed by southeast coast (Rs. 3,682 lakhs), northwest coast (Rs. 3,506 lakhs) and northeast coast (Rs. 2,702 lakhs). At the national level, the value was estimated at Rs. 10,970 lakhs at the landing centre price level and Rs. 18,235 lakhs at the retail price level. Thus, the ban helps the fish to grow and improve its value.

SPAWNING AND RECRUITMENT

Spawning season

It is believed that spawning of commercially important fish stocks takes place during June - September (SW monsoon) along the west coast and during April - May along the east coast. This is one of the considerations for closure of fishing during these periods. To verify the spawning season of finfishes and shellfishes, the available published information have been consolidated and presented in Fig. 13 and 14. It could be found that several species have a prolonged spawning season. It is very common to find species that spawn for six months or for much longer duration in a year. This is the typical character of tropical stocks and in any given month, there are a number of species that spawn. Moreover, the same species spawns during different seasons in different localities. Hence, spawning season could not be considered as the sole criterion for deciding the season of fishing ban.

Impact of ban on recruitment of demersal fishery resources

Monthly recruitment of five dominant finfish species in the trawl landings at Cochin Fisheries Harbour during 2008-2009 was estimated (Table 6). It is found that the monthly recruitment is skewed towards later half of the year. The recruitment, which was estimated from the three lowest length categories of landed resources, was high immediately after the ban season. More than 30-40% of the annual recruits are accounted for by the post-ban months of August and September, which indicates enhanced recruitment for a short duration after the ban season.

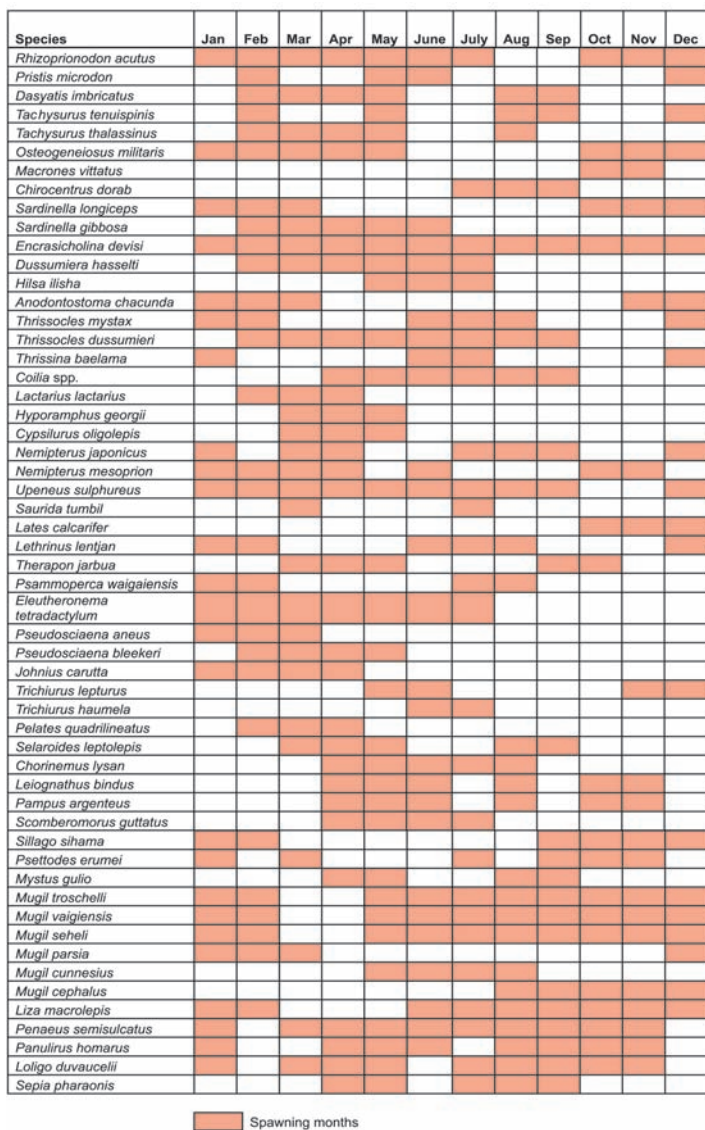


Fig.13. Spawning months of dominant finfish and shellfish along the east coast (from different published sources)

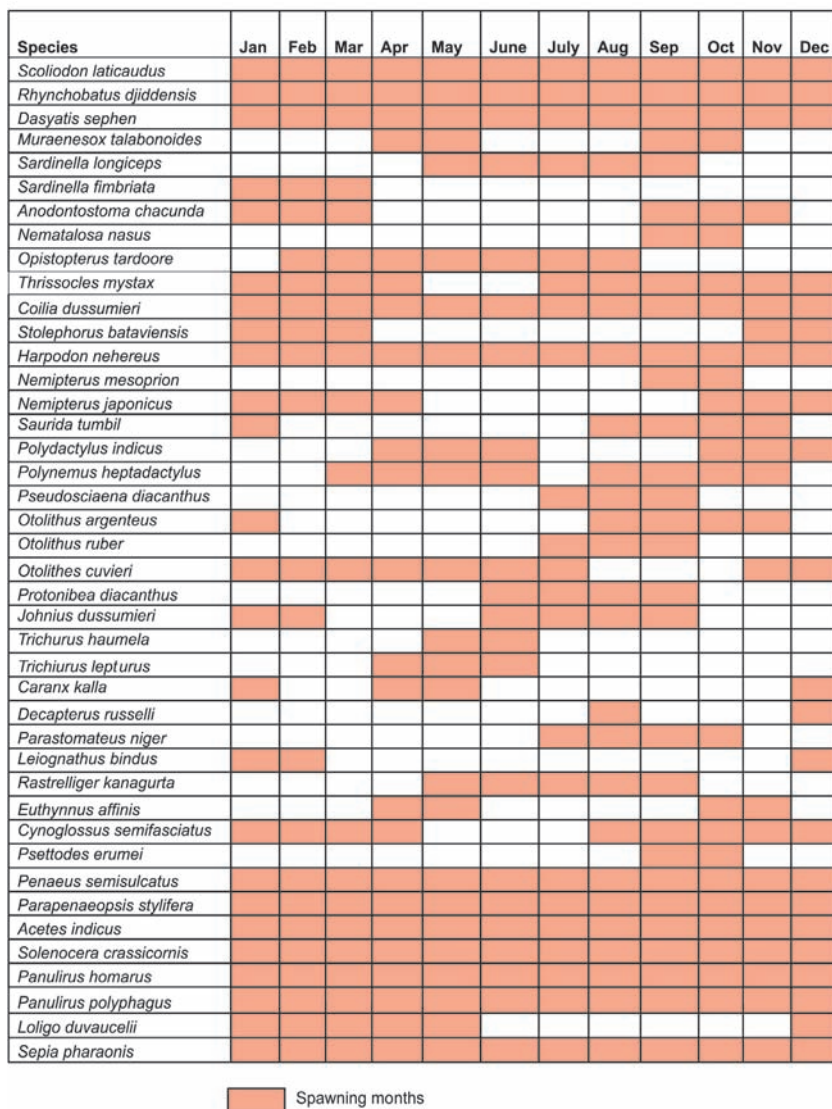


Fig.14. Spawning months of dominant finfish and shellfish along the west coast (from different published sources)

Table 6. Monthly recruitment as percentage of annual recruitment of five species of demersal finfishes landed by trawlers at Cochin Fisheries Harbour during 2008 and 2009

Month	<i>Cynoglossus macrostomus</i>	<i>Nemipterus japonicus</i>	<i>Nemipterus mesoprion</i>	<i>Saurida tumbil</i>	<i>Saurida undosquamis</i>
January	0.0	1.2	4.9	0.0	14.5
February	15.2	0.0	0.0	0.0	6.6
March	0.0	11.2	0.0	3.4	0.0
April	2.6	12.4	0.0	0.0	0.0
May	0.0	10.0	23.5	25.1	0.0
June	0.0	0.0	11.1	22.8	18.7
July	TRAWL BAN				
August	16.7	7.8	20.7	0.0	0.0
September	39.5	16.5	19.0	0.0	17.9
October	23.1	24.6	7.5	19.3	21.1
November	1.9	16.3	0.0	7.6	10.0
December	1.0	0.0	13.3	21.8	11.2

Exploitation of spawners of small pelagics during fishing ban

The motorised craft with <10 hp are exempted from seasonal fishing ban. To find out whether motorised boats catch large numbers of spawners and juveniles when the ban exists for larger boats, the length composition and maturity condition of the major small pelagics namely, the oil sardine (*Sardinella longiceps*) and Indian mackerel (*Rastrelliger kanagurta*) caught by motorised boats during the monsoon ban period along the southwest coast were compared with that of the corresponding annual data.

Ringseine was the major gear employed for the exploitation of oil sardine and contributed 83% to the landings followed by gillnets (12%), boatseines (3%) and the rest by non-mechanised sector. It is found that the annual spawning stock biomass contributed 37% to the annual standing stock biomass. The length range of oil sardine landed by ringseine was 90 -170 mm with a mean of 145 mm and mode of 130 mm. The spawners of oil sardine (140-160 mm) are caught during

June-July along the Kerala coast and during July-September along the Karnataka coast. The analysis of biological data on oil sardine during 2006-2008 along the southwest coast shows that more than 70% of gravid and spent individuals were encountered in July (ban period; Table 7). Thus, a substantial quantity of spawning biomass of oil sardine is exploited by the motorised units along the southwest coast during the ban period. However, the estimates show that the oil sardine catch has increased substantially in the last 15 years, indicating that the exploitation of spawners at the present level has not affected the stock.

Table 7. Maturity condition of the oil sardine *Sardinella longiceps* and the Indian mackerel *Rastrelliger kanagurta* during SW monsoon and their contribution (%) to the annual landings by motorised ringseine units along the southwest coast of India (2006-2008)

Parameter		<i>Sardinella longiceps</i>		<i>Rastrelliger kanagurta</i>	
		July	Aug	July	Aug
Length range (mm)		85-205	90-200	85-205	85-205
Mean length (mm)		150	149	170	186
Maturity (%)	Immature	4	15	46	70
	Mature	18	24	32	5
	Gravid/spent	71	0	7	15
Annual mean length (mm)		136		201	

The major season for mackerel fishery starts by August and lasts till December. Ringseines contribute 74% to the mackerel catch followed by drift gillnets (20%), hooks and lines (2%) and trawls (3%). Along south Kerala coast, the annual length range of mackerel was 80 –285 mm and was 85-205 mm during July and August. Gravid and spent individuals contributed only 7 to 15% during the monsoon months (Table 7) showing that exploitation of spawners of mackerel by the motorised units was low during the ban period.

EMPLOYMENT DURING SEASONAL FISHING BAN

SFB has an impact on the socio-economic condition of the fisherfolk. In selected centres of Andhra Pradesh and Kerala, a study was conducted on fishermen in the mechanised sector by analysing the data collected on their occupation, income, debt and consumption pattern during the ban and non-ban period. The data were collected from three groups of stakeholders namely trawl owners, crew members and support service providers like ice suppliers, drinking water providers and deck cleaning boys.

Andhra Pradesh

In all the three groups, fishing was the prime source of income during the non-ban period. However, about 30 per cent of the fisherfolk work in non-fishery enterprises like farming (agriculture), civil construction work and the iron ore plant near the Kakinada Fisheries Harbour.

During the ban period, 40 per cent of the trawl owners were engaged in local business activities while the rest 60 per cent were idle and attended to the maintenance of craft and gear. Regarding the crew, 66 per cent found employment in civil construction work, farming operations and a few miscellaneous jobs while the rest were idle. In the service provider sector, 58 per cent of the respondents were engaged in petty employments in non-fishery enterprises and the rest attended to unskilled jobs within the fishing villages.

The trawl owners were employed, on an average, for 24 hours per week during the ban period. The women and children of the trawl owners' households did not go for any employment during this period.

The crew were engaged for 67 hours per week during the ban period against 118 hours per week during the non-ban period. The women got employment for 66 hours per week during the ban period and 113 hours per week during the fishing period. The children were also engaged in petty jobs for 57 hours per week during the ban period against 86 hours during the fishing season.

For the service providers, the average hours of employment during the ban period worked out to 35 hours per week against 38 hours per week during the fishing season. The women in the service providers' households were employed for 48 hours per week during the ban period against 42 hours in the fishing season. The children were employed for 38 hours per week during the ban period and 40 hours per week during the fishing season. It is seen that for the service providers, there is only a marginal decline in the average hours of employment in the ban season.

Kerala

In Kerala too, the fishermen and other stakeholders are engaging themselves in any one of the income earning activities like business, construction work and other non-fishing activities.

In case of trawl owners at Cochin Fisheries Harbour, 38 per cent were engaged in small business activities during the ban period, while in Munambam, 85 per cent were engaged in business and other activities. In Sakthikulangara, 46 per cent of the trawl owners were engaged in business and other activities, while in Beypore, 100 per cent involvement in other small income earning activities was observed.

In case of crew, at Cochin Fisheries Harbour, during ban period, 68 per cent of the respondents worked as construction workers, 14 per cent

in net making enterprises, nine per cent in other income earning activities and the remaining nine per cent were idle. At Munambam also, a similar trend was observed with 69 per cent of the crew working in construction sites, 15 per cent in net making and the rest in other income earning activities. In Sakthikulangara, 63 per cent of the crew were engaged in construction work, nine per cent as agricultural labourers, six per cent in net making and 22 per cent in other income earning activities. In Beypore, 77 per cent of the crew worked in other income earning activities while 20 per cent were engaged in construction work.

In the case of service providers, at Cochin Fisheries Harbour, 63 percent of the respondents worked as construction workers during the ban period, while 29 per cent worked in net making units and the rest in other income earning activities. At Munambam, 50 per cent of the service providers worked in construction site during the ban period, while 17 per cent worked in net making units and 33 per cent in other activities. In Sakthikulangara, 63 per cent of the respondents worked in net making units during the ban period, while 33 per cent worked in other economic activities. In Beypore, 57 per cent were working in construction work and 29 per cent in net making units during ban period.

Thus it is observed that the fisherfolk are engaged in different livelihood options like construction work, net making and petty business activities during the ban period.

STAKEHOLDERS' VIEWS ON SEASONAL FISHING BAN

To elicit the opinion of the stakeholders on SFB, its duration and its impact, stakeholders' meetings were arranged in all the maritime states of India. The views of the Department of Fisheries of a few maritime states were also obtained.

The following basic issues were considered during the discussion: (1) the need for continuation of existing ban in future; (2) period of ban; (3) duration of ban; and (4) beneficiaries of ban.

Andhra Pradesh

A meeting of the representatives of different stakeholders' associations involved with marine fisheries and the Department of Fisheries officials in Andhra Pradesh was convened at Visakhapatnam Regional Centre of CMFRI. The suggestions that emerged from the group discussion of the stakeholders are as follows:

1. Fishing ban is required, but may be restricted only to the mechanised sector for 60 days during April-June.
2. A closed season helps in conserving the fishery and allows the fishery to recover from extreme fishing pressure.
3. Pollution from the discharge of many chemical factories along the coast is of great concern and immediate measures have to be taken to prevent further damage to the fishery.
4. A good marketing system should be established by providing cold storage facilities along the coast and by fixing a minimum support price to all commercially important fishes.
5. Grant of permits to foreign vessels for fishing in the Indian EEZ should be stopped.

6. Open sea floating cage culture integrated with hatcheries should be promoted along the coast to provide alternate livelihood to fishermen. One or two members, preferably youth, from each fishermen co-operative society should be given training in open sea floating cage culture.

Tamil Nadu

The stakeholders' meeting was held at three Centres of CMFRI namely, Chennai, Mandapam and Tuticorin. The suggestions are as follows:

1. Provide relief amount for the ban period @ Rs. 200/- per day and/or Rs. 9,000/- for 45 days.
2. Non-ringseine operators wanted ban on ringseines in all seasons.
3. Ban foreign vessels (for example Sri Lankan boats) during the fishing ban period. Coastguard officials requested that the fishermen should inform the coastguard for enabling them to seize the catch and boats of the poachers and take legal action as per government's instructions.
4. When the fishermen expressed their difficulties of holding ID card during fishing operation, it was emphasised by coastguard officials that the fishermen should hold ID card in their own interest, considering the security measures followed by the government.
5. Pay compensation to the fishermen who lost their nets by intruding ships.
6. Trawl nets should have minimum 25 mm cod-end mesh size.
7. The trawl owners and workers are of the opinion that the ban period should be during November – December instead of April – May. The reasons they attribute are that (i) the breeding of some of the

fishes, molluscs and crustaceans especially shrimps is during this period, (ii) November and December are not safe for fishing due to rough weather conditions related to northeast monsoon; (iii) the season is lean for trawl catch. The State Fisheries officials of Tuticorin opined that the suggestions of the trawl owners may be considered. However, the researchers should confirm whether November and December is the actual peak spawning season for commercially important fishes.

8. The trawl owners and workers suggested that other boats such as minitrawls should be included under the ban. When large trawlers abstain from fishing, the minitrawlers fish in the coastal waters and catch juveniles of shrimps and fish. Hence the ban is not effective.
9. Presently, the southernmost part of Tamil Nadu like Colachel in Kanyakumari district, which is located in the west coast, follows the trawl ban of Kerala, which is during June-July. So, they fish in the Gulf of Mannar during April-May which is the ban period for Tamil Nadu. There is a need for uniform ban in Tamilnadu.
10. The stakeholders wanted strict enforcement of ban for all trawlers and large vessels which come from neighbouring states and countries.

Kerala

A multi-stakeholder meeting was held to elicit responses from various stakeholders. Their opinions are summarised below :

1. The fishermen of mechanised sector suggested that the ban should be removed. They informed that they are losing revenue by the loss of *karikadi* (*Parapenaeopsis stylifera*) fishing which coincides with the ban period. They also challenged that if the ban is relaxed for a week in July, they can harvest large quantities of *karikadi*.

2. On the contrary, the motorised and traditional fishermen suggested that the ban duration may be increased upto 90 days.
3. The mechanised sector felt that the period of ban should be during December - January instead of June - July. However, this opinion was highly divided.
4. One section of fishermen felt that small mesh sized gears operated by the motorised craft should be completely stopped.
5. The operation of foreign trawlers in Indian waters during the ban period should be eliminated completely.

Karnataka

A meeting of the stakeholders of mechanised, motorised and non-motorised sectors was held along with the officials of the State Fisheries Department. The opinion of the various groups is summarized as follows:

1. The ban period of 45 days is insufficient. It may be extended for 90 days from 1st June to 31st August all along the west coast.
2. The ban should be for all types of craft and gear with the exemption of shoreseines and traditional fishermen who fish without inboard or outboard motors.
3. Without strictly implementing mesh size regulation, there will be no use of ban for even 3 months.
4. Night fishing should be strictly banned as it keeps the fish stocks continuously under stress.
5. Multi-day fishing should be strictly regulated as it leads to overexploitation in the deeper areas, thereby seriously affecting demersal resources in the inshore waters. The fishermen quoted the example of Karwar where daily trawlers (single day trawlers) are

idling for nine months in a year as they are unable to realise even one tenth of their cost of fishing from April to December. This severely affects the livelihood of fishermen.

6. Fishermen opined that destructive gears like stakenets operating in the backwaters affect the recruitment of young prawns into the fishery and demanded immediate ban on these gears. They expressed their feeling that unless government takes bold initiatives, the resources will face severe threats and quoted that many resources have already become commercially insignificant.
7. All the participants expressed their view that government should compensate the fishermen to overcome the financial difficulties they are facing during the ban period.
8. Fishermen should be provided with sustainable alternate livelihoods so as to reduce their dependency on fishing during lean seasons.
9. Conservation efforts are needed with community participation for sustaining the resources in the inshore and offshore waters.
10. Many fishermen opined that registration of vessels both in the mechanised and motorised sectors should be made compulsory and boats without registration should be seized and impounded.
11. Number of multi-day trawlers should be restricted in each state and in each harbour. No additional vessels should be registered or permitted to fish. Only replacement of the existing vessels should be allowed.
12. Mesh size of each type of gear may be scientifically prescribed and state fisheries departments with involvement of research institutes may enforce strict compliance and impose strict penalty for violations.

13. Issuing license to foreign vessels for fishing in Indian waters may be immediately stopped as these vessels are fishing in the inshore waters depriving the fishermen of resources on which their livelihood depends. Fishermen informed that these vessels fish in the nearshore areas during nights and also during the ban period.
14. Patrolling the territorial waters by the coastal police and in the EEZ by the coastguard and Navy may be carried out continuously to stop illegal fishing and poaching of fishery resources by foreign fishing vessels.

Maharashtra

A meeting of stakeholders was organised at Mumbai Research Centre of CMFRI.

1. From the response of the stakeholders it is observed that monsoon fishing ban is beneficial to 63% of stakeholders. The remaining 37% expressed that there was no impact of the ban. The benefits of the ban were stated as better catch during post-ban period (56%) and improved health of the stock (32%). About 6% of the stakeholders stated that the ban impacted them adversely. Among these stakeholders 57% reported loss of livelihood and 43% complained of reduced income.
2. In order to compensate for the loss / reduced income, 89% stakeholders demanded support from the government, while 11% suggested alternate livelihood support.
3. Most of the stakeholders (86%) expressed the need of fishing ban during monsoon but opined that the ban should be implemented for all fishing vessels.
4. About 60% of the respondents felt that the present period from 10th June to 15th August for about 65 days is adequate but remaining

40% stated it should be extended for 90 days from 15th May to 15th August.

5. Regarding uniformity of the ban throughout the country, 36% wanted uniform ban, 21% for uniform ban along the west coast and 27% for uniform ban within the State.

Gujarat

In the stakeholders' meeting held at Veraval, representatives from different organizations, entrepreneurs, officers from the State and Central Governments and fishermen and their associations participated and exchanged their views on the ban.

1. While the continuation of ban was accepted by the stakeholders, the preferred period varied. While the entrepreneurs and fisheries department officials opined that the ban should be from 9th June to 9th September, the fishermen expressed that it should be as it is now, but should be uniform along the entire west coast.
2. While the ban was favoured for all fishing craft, the owners of motorised boats did not accept and wanted exemption from the ban.
3. They also suggested enforcing ban on marketing juveniles of seerfish, pomfrets, cuttlefish, *koth* and *ghol*.
4. It was suggested that hooks & line fishery alone should be allowed during fishing ban, which was not agreed by all the traditional fishermen.
5. Government should enforce use of approved codend mesh size in the trawlnets to protect the juveniles and use of fish finders to avoid catching the juveniles.

LIMITATIONS OF THE BRIEF

1. This Policy Brief is a retrospective analysis by using data collected homogeneously on a routine basis, without specific reference to seasonal fishing ban. Thus, this is an effort to mine out certain cause-effect mechanisms from macrodynamic data.
2. The fishing methods are constantly improvised. Technological innovations increase the fishing efficiency and the area of fishing. These factors, in future, may change the conclusions drawn in this Policy Brief.
3. Experimental fishing during fishing ban period may provide better information on stocks during periods of non-exploitation.
4. In a multigear, multispecies situation, the response of each stock to fishing is different from that of others. Moreover, the same species is harvested by different gears. Hence, arriving at conclusions, which are common to all fish stocks and gears, is not possible.
5. In the stakeholders' meetings, a tendency to safeguard their own benefits was evident among each group. Hence, it is likely that the opinion of the stakeholders on the seasonal fishing ban is skewed, to a large extent.

CONCLUSIONS AND RECOMMENDATIONS

- i There is no significant difference in catch and CPUE trends before and after introduction of fishing ban along the west coast. However, there is marginal improvement in catch and CPUE trends after introduction of fishing ban for different species/groups of fish along the east coast.
- ii The increase in catches along the Indian coast is essentially due to increase in efficiency of craft and gear and extension of fishing to offshore regions in the last two decades.
- iii Seasonal fishing ban has helped arresting the increasing annual fishing effort. Removal of seasonal fishing ban will result in spurt in fishing effort, which is detrimental to fish stocks.
- iv Seasonal ban helps the fish to grow, thereby improving the price and value.
- v Boats with outboard motors with different engine capacity have become dominant in the fishery all along the Indian coast. When the ban exists for larger boats, removal of large quantities of spawners of small pelagics by motorised craft is evident. Proper regulations of these boats are important.
- vi There is an improvement in recruitment of dominant demersal species into the fishery immediately after the ban, but for a short duration of one to two months.
- vii Many species have a prolonged spawning season lasting for 6 to 7 months, but with peak spawning at least twice a year. As these spawning peaks are during different months for different species,

spawning period could not be considered as the sole criterion for the period or duration of closure.

- viii There is no indication to suggest that fishing ban has helped long-term sustainability of stocks. Perhaps a combination of several other regulatory measures such as minimum/maximum legal size at capture, mesh size regulation, licensing, regulation of operation of motorised boats and capping the number of boats are necessary along with seasonal closure for replenishment of fish stocks.
- ix Meetings with stakeholders showed differing views between fisherfolk of maritime states; and among mechanised, motorised and artisanal sectors. In general, the mechanised sector wants the ban to be removed (showing that some shrimps, which are abundant during the ban period are not harvested); the motorised sector wants not only increasing the ban duration on mechanised sector to 90 days, but also exemption of motorised boats from ban.
- x Most of the employees get engaged in fishing-related or un-related jobs during the ban period. However, they demand government support during the period of closure.
- xi Increased awareness among the fisherfolk towards issues of sustainability is evident. If convinced, they are willing to listen to and comply with fisheries regulatory measures.
- xii Considering the changing fisheries scenario, regular monitoring and impact assessments are imperative to suggest timely management measures.

Based on the above-mentioned conclusions, the following recommendations are made:

- i The seasonal closure of mechanised fishing may continue for 47 days from April 15th to May 31st along the east coast and from 15th June to 31st July along the west coast. Thus the mechanised fishing will start on 1st June along the east coast and from 1st August along the west coast.
- ii Boats with less than 10 hp engine capacity along east coast and with less than 25 hp along the west coast and all the non-motorised boats may be exempted from the ban.
- iii Government of India must prevent poaching by foreign vessels within Indian EEZ.
- iv The governments may strive to implement other regulatory measures such as minimum/maximum legal size at capture, mesh size regulation, licensing, regulation of operation of motorised boats and capping the number of mechanised boats.
- v The governments may initiate the process of implementing Ecosystem-based Fisheries Management and FAO Code of Conduct for Responsible Fisheries for stock enhancement and maintaining equity among different stakeholders.
- vi The MFRAs are nearly three decades old. As fisheries development and issues have changed in the last three decades, the DAHD & F, in consultation with fisheries research institutions like CMFRI, may prepare a model MFRA, which may pave the way for revising the MFRA by the state governments to cater to the needs of current issues.

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